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ON THE RACES OF *KINIXYS BELLIANA* GRAY

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When I noticed the peculiarities of *Kinixys belliana* from northeastern Congo, I suspected that these populations might represent a race already described by Rüppell under the name of *schoensis*, but I did not have Rüppell's description. Dr. Mertens kindly gave me the necessary information and it became evident that these populations were different from *schoensis*, and I therefore described the race *mertensi* (1956). Dr. Mertens (*in litt.*) declared that *schoensis* was in his opinion a valid race, but he apparently changed his mind, since the rehabilitation of *schoensis* has never appeared (Wermuth and Mertens, 1961). In preparation for a checklist of the turtles of Africa, I have now reinvestigated the validity of *schoensis* and also the range of *mertensi* toward the east and northeast.

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This paper limits itself to the examination, with the aid of the ratios already used in the description of *mertensi*, of two questions: (1) Is *schoensis* Rüppell recognizable as a northeastern race, and (2) does *mertensi* connect with the typical form by a smooth cline in which no objective limits could be formulated for the eastern distribution of the race?

Measurements, additional to those taken for the description of *mertensi* (1956) (i.e. on other specimens), were taken on the MCZ specimens; Miss A. G. C. Grandison, with her customary kindness, sent the pertinent measurements for specimens from northeastern Africa and Uganda. Mr. A. Opdenbosch furnished also data on a large series of *K. belliana* from the Congo.

Admittedly, the method of relying on other persons to take measurements has serious drawbacks since it can introduce bias in the data. For amphibians the discrepancies are very great indeed, but as far as turtles are concerned it has been hoped that the measurements are generally so easily definable that these discrepancies would be almost negligible. However, the comparison of the ratios already published (Laurent 1956) with those calculated on Opdenbosch's measurements disclosed a considerable bias in the breadth of the carapace (maximum breadth, and breadth on level of lateral ends of humero-pectoral sutures). Even disregarding these data, the variation of *belliana* is such that the validity of *schoensis* appears untenable on present evidence. [Of course, other characters may prove some day that the northeastern populations or even some others from east or southern Africa are subspecifically differentiated.] Thus, in regard to the four ratios used in my previous work (Laurent 1956) the situation is as follows.

1. From the data at hand in 1956, the general shape of the carapace seemed definitely different in *mertensi* and "*schoensis*" and *belliana*. The carapace breadth (at the level of the lateral ends of the humero-pectoral suture) in per cent of the maximum breadth (back part of the carapace) was 87.2 to 97.8 ($m = 92$ for nine specimens) for *belliana*, 78.7 to 90.3 ($m = 85.67$ for fifteen specimens) for *mertensi* and 83.8 for the type of *schoensis*. The overlap was slight enough to make unnecessary any test for significance of the difference. However, the data now at hand are definitely less conclusive. The difference seems to be still statistically significant between *mertensi* and the complex of populations from eastern and southern Africa which we call *belliana* but which surely cannot be considered as homogeneous. Also, because bias is obvious in these rather difficult measurements and because other differences are more clearcut, it has not been found worthwhile to make any statistical calculations. The specimens from Sudan, Abyssinia and Somaliland do not appear to be significantly distinct from those from East Africa, though more

consistent measurements taken on more numerous specimens could some day disclose a valid difference.

2. In my 1956 work the ratio between the median gular suture plus the median humeral suture and the breadth of the plastron at the level of the lateral ends of the humero-pectoral sutures was seen to show a very clearcut difference between *belliana* and *mertensi* — the figures being 56.7 to 73.3 ($m = 66.87$) for *belliana* (N=9), 72.9 to 91 for *mertensi* (N=15). The new data are *ana* (N=9), 72.9 to 91 (m=84.92) for *mertensi* (N=15). The new data are still reliable as the measurements are not likely to suffer from individual bias. The ratios now obtained are as follows (expressed in percentage):

a) *belliana* ($N = 87$) 49.5-82.8 $m = 66.45$ $v = 12.51$
b) *mertensi* ($N = 22$) (57)[1] 75-94 $m = 84.18$ $v = 12.47$
c) *"schoensis"* ($N = 8$) 55.7-71.7 $m = 69.13$ $v = 10.80$
d) *nogueyi* ($N = 3$) 65.4-73-83.1

The variation coefficients are high because the samples are heterogeneous from the point of view of size and consequently of age. In the *mertensi-belliana* and *belliana-"schoensis"* comparison, Student's t is respectively 8.45716 and 8.25106, which shows highly significant differences in view of the small number of specimens.

3. The ratio between the pectoral suture and the sum of the gular and humeral sutures gives the following figures:

a) *belliana* ($N = 87$) 25.6-69 $m = 42.01$ $v = 18.30$
b) *mertensi* ($N = 21$) 0-31 $m = 19$ $v = 41.51$
c) *"schoensis"* ($N = 8$) 31.4-42.3 $m = 34.50$ $v = 9.86$
d) *nogueyi* ($N = 3$) 27.8-27.8-39.1

Notwithstanding an enormous variation coefficient in *mertensi*, t shows a significant difference between *mertensi* and *"schoensis"* ($t = 5.32$) and *mertensi* and *belliana* ($t = 12.71$) but not between *belliana* and *"schoensis."*

4. The ratio between the pectoral and the abdominal sutures gives the following figures:

a) *belliana* ($N = 86$) 21.3-60 $m = 39.89$ $v = 25.81$
b) *mertensi* ($N = 21$) 0-31.2 $m = 18.71$ $v = 42.98$
c) *"schoensis"* ($N = 8$) 29.4-37.4 $m = 33.5$ $v = 8.62$
d) *nogueyi* ($N = 3$) 22.4-36

[1] The low figure 57 comes from a juvenile.

Only the difference between "*schoensis*" and *mertensi* proves to be significant with a t of 5.03.

Two other ratios not previously used but combining the same measurements have proven useful.

1. The ratio between pectoral suture and the maximum width of the carapace:

a) *belliana* ($N = 87$) 11.3-24 $m = 16.51$ $v = 18.50$
b) *mertensi* ($N = 21$) 0-13.8 $m = 8.95$ $v = 41.87$
c) "*schoensis*" ($N = 7$) 11.6-15.3 $m = 12.86$ $v = 13.83$

Student's t is significant between *belliana* and *mertensi* (9.48), and between "*schoensis*" and *mertensi* (6.65), dubiously significant between *belliana* and "*schoensis*" (3.11).

The same relation between *belliana* and "*schoensis*" becomes, however, significant if analyzed by regression lines ($t = 4.26$).

2. The ratio between the width of the plastron at level of the lateral ends of the humero-pectoral suture and at the abdominal suture:

a) *belliana* ($N = 86$) 110-200% $m = 145.45$ $v = 11.30$
b) *mertensi* ($N = 21$) 103-147% $m = 114.52$ $v = 31.54$

Student's t (8.05) is highly significant.

As a result of these computations, *mertensi* appears definitely valid, but "*schoensis*" seems to be so only for two ratios: 1. the ratio of the sum of humeral and gular sutures to the breadth of the plastron at the level of the humero-pectoral suture and 2. the regression line for the correlation between the length of the pectoral suture and the maximum breadth of the carapace.

From a taxonomic point of view, it does not seem advisable to revive "*schoensis*" on such slender evidence — more especially as the *belliana* sample is geographically highly heterogeneous. A complex clinal variation from Rhodesia to Ethiopia is possible, since we have no data from the populations between Kenya and Ethiopia or Eritrea. Some records from Eritrea (Sordelli 1901, Calabresi 1927, Scortecci 1928) disclose a shortening of the pectoral suture, as in *mertensi*.

On the other hand, no east-west cline exists between *mertensi* and *belliana:* the British Museum specimens from Entebbe and Mount Elgon are clearly *mertensi*.

The two questions propounded have thus the following answers:

(1) A race "*schoensis*" cannot now be revived for the northeastern populations of *Kinixys belliana*.

(2) The distribution of *Kinixys belliana mertensi* includes Uganda, but its northern limit remains unknown.

These conclusions are still provisional. More material could prove not only that "*schoensis*" is valid but that other subspecies can be recognized, or on the contrary that even *mertensi* merges in *belliana* through Sudanese and Abyssinian populations.

Material examined

Kinixys belliana belliana Gray

MUSEUM OF COMPARATIVE ZOOLOGY: *Sudan:* Torit (1). *Kenya:* Golbanti (1), Ithanga Hills (1), Kibwezi (1), Voi (5). *Tanganyika:* Amboni (1), Kilosa (1), Kiponda to Mitungu (1), Kitaya (1), Mikindani (4), Morogoro (1), Simo near Tabora (2), Turiani (1), Ujiji (2). *Zanzibar Island:* Zanzibar (1). *Nyasaland:* Cholo Mtn. (1), Mtimbuka (5). *Northern Rhodesia:* Isoka (1). *Southern Rhodesia:* Birchenough Bridge (1), Bulawayo (1), Hot Springs (2), Lumani (1), Selinda Mtn. (3), Umtali (1). *Transvaal:* Naauwpoort (1). *Katanga:* Kapiri (1), Lukafu (1).

BRITISH MUSEUM (NATURAL HISTORY): *Sudan:* Kadugli (1). *Ethiopia* (1), Anseba (2). *Somaliland:* Berbera (1), near Berbera (1).

MUSÉE ROYAL DE L'AFRIQUE CENTRALE (Tervuren, Belgium). *Kenya:* Kibwezi (1), Voi (1). *Northern Rhodesia:* Abercorn (3). *Katanga:* Kabambaie (1), Kabinda (1), Kakanda (3), Kansenia (12), Kapiri (8), Lofoi sources (1), Lukafu (2), Lukonzolwa (4), Mwera (1), Ste. Walburge (2). *Kivu:* Makunga (2).

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MUSEUM OF COMPARATIVE ZOOLOGY: *Ituri:* Mahagi-Port (1).

BRITISH MUSEUM (NATURAL HISTORY): *Uganda:* Entebbe (1), Mt. Elgon (2).

MUSÉE ROYAL DE L'AFRIQUE CENTRALE (Tervuren, Belgium). *Congo*, without locality (4). *Uele:* Dika (3), Mauda (1), Niangara (1). *Ituri* (1): Abimva (1), Gangala na Bodio (3), Mahagi-Port (3). *Stanleyville District:* Avakubi (1).

Kinixys belliana nogueyi Lataste.

MUSEUM OF COMPARATIVE ZOOLOGY: *Dahomey:* Bassila (1). *Togo:* Tohoun (1). *Sierra Leone:* Kabala (1).

Two specimens from Lukolela (western Congo: M.A.C. 4648)[1] and from the Kwango District (southwestern Congo: M.A.C. 10736) suggest that a differentiated population exists in the lower Congo region, which somewhat resembles *mertensi* in having a short pectoral suture and a long abdominal suture. Other specimens are, of course, needed.

Key to the races of Kinixys belliana

A. Forelimb with 4 claws — Range: Western and northern Cameroon, west to Senegal. ..... *K. b. nogueyi* Lataste

B. Forelimb with 5 claws (occasional specimens have 4 claws)

1—Ratio between the median gular suture + the median humeral suture and the breadth of the plastron at the level of the lateral ends of the humero-pectoral sutures: 75 to 94% (less than 75 in juveniles). Ratio between the pectoral suture and the sum of the gular and humeral sutures: 0–31%

Range: Northeastern Congo and Uganda (presumably also République Centre Africaine and eastern Cameroon).

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2—These ratios, respectively, 49 to 83% and 25 to 69%.

Range: Sudan east to Eritrea and Somaliland, south to Natal, northwest to Angola and southern Congo.

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BIBLIOGRAPHY

Calabresi, E.

1927. Anfibi e rettili raccolti nella Somalia dai Proff. G. Stefanini N. Puccioni. Atti. Soc. Ital. Sci. Nat. Milano, **66**: 14-60, pl. I.

Laurent, R. F.

1956. Contribution à l'herpétologie de la région des Grands Lacs de l'Afrique Centrale. I. Généralités. II. Chéloniens. III. Ophidiens. Ann. Mus. Congo, Zool., **48**: 1-390, pls. I-XXXI.

Scortecci, G.

1928. Rettili dell 'Eritrea esistenti nelle collezioni del 'Museo Civico di Milano. Atti Soc. Ital. Sci. Nat. Milano, **67**: 290-339, figs. 1-8, pls. VII-IX.

Sordelli, F.

1901. Anomalia in una testuggine (*Cinixys belliana*) del Sudan Orientale. Atti Soc. Ital. Sci. Nat. Milano, **39**: 111-114, figs. 1-2.

Wermuth H. and R. Mertens

1961. Schildkröten. Krokodile. Brückenechsen. G. Fischer, Jena.

[1] M.A.C.: Musée Royal de l'Afrique Centrale (Tervuren).